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ENTOMOLOGY.<sup>1</sup>

**Rectal Glands in Coleoptera.**—While studying the histology of *Passalus coenutus* Fab., recently, I found in the alimentary canal, between the colon and rectum, a structure which I consider homologous with the similarly located rectal glands of other groups of insects.

The colon has six longitudinal rows of diverticula, each diverticulum being in depth about one-third of the diameter of the colon. It consists of a somewhat spiny chitinous layer. Next is the lumen, external to which is a layer of cubical epithelial cells. Next is a layer of circular muscle fibres, and, alternating with the six rows of diverticula, six bands of longitudinal muscle fibres.

The rectum has a lining of smooth chitin resting on an epithelial layer, the cells of which are slightly more columnar than those of the colon or of the intervening structure. Then come scattered circular muscles and six bundles of longitudinal fibres.

The anterior end of the structure uniting the colon and rectum forms the posterior wall of the last diverticulum of each row. Rising towards the lumen proper, from the bottom of this diverticulum, the wall soon bends posteriorly, forming a sort of side pocket, then returns and completes the posterior side of the diverticulum. The wall now passes backward for a distance about equal to that of three diverticula, then turns outward and slightly forward forming a small groove around the tube. It then bends back, narrowing the diameter of the lumen and making this rather conical, then gradually widens and becomes modified to form the rectum.

The anterior of these two parts of the structure I shall term the cushion, and the posterior portion, the cone. In cross-section the cushion is seen to consist of six longitudinal ridges, each ridge continuing the line of a row of the diverticula of the colon. The chitin in the last of these is smooth, but when it bends and forms the inner face of the cushion it becomes thickly set with short blunt spines, which point backwards. There are no spines in the groove between the cushion and the cone, but they begin at the posterior edge of the groove, and continue from this point to the rectum.

In both cushion and cone the underlying epithelium is cubical and contains prominent nuclei. It shows no traces of a glandular function.

The muscles are greatly developed. At the anterior end of the cushion they pass from one side of a ridge to the other, and between

<sup>1</sup> This department is edited by Prof. J. H. Comstock, Cornell University, Ithaca, N. Y., to whom communications, books for notice, etc., should be sent.

the ridges the six longitudinal bands are continued from the colon. Passing back the muscles become oblique, and external to the groove they are entirely longitudinal. In the cone they are oblique, then circular, and near the rectum a few oblique ones again appear. External to the muscles is scattered connective tissue. Tracheas and nerve fibres enter and ramify in the structure.

The ridges which compose the cushion are quite marked anteriorly and have a central median groove. Posteriorly the ridges are less marked, the median grooves becoming as deep as those separating the ridges.

Both from its histology and its position I regard this structure as a true rectal gland. Its function, however, I believe to be that of a valve. Minot (Histology of the Locust) says that Chun's decision as to their function is only "a speculative opinion." In favor of their being valves we find the following facts:

1. They are the best developed, and the most alike in insects which feed on solid and quite innutritious food. In those forms with more concentrated or liquid food they vary greatly and may even be wanting.

2. Their structure is to be best explained by the assumption of a valvular function. This explains the thick spiny chitinous lining and the remarkable development of the muscles.

3. Their location is explained by this assumption, for a valve at this point would serve to retain the food in the absorptive portions of the digestive track till all nutriment was extracted; then the combined action of the spines and of peristaltis of the muscles would pass the remainder on.

The rectal glands therefore would retain their primitive valvular function in those insects which have retained their primitive food habits. In the more highly differentiated forms, with concentrated food they become modified, serving other purposes or are rudimentary.—H. T. FERNALD.

#### EXPLANATION OF FIGURES, PLATES IV. AND V.

FIG. 1. Longitudinal section of the rectal gland of *Passalus*, x 50 (about). *C.* colon, *R.* rectum, *ch.* chitin layer, *cir. m.* circular muscle fibres, *cone* cone, *c. t.* connective tissue, *cush.* cushion, *ep.* epithelium, *l. m.* longitudinal muscle fibres, *tr.* trachea.

FIG. 2. Cross section along line *AB* of Fig. 1 x 90.

FIG. 3. Cross section along line *CD* of Fig. 1 x 90.

FIG. 4. Cross section along line *EF* of Fig. 1 x 90.